# Seaweed Polysaccharide and applications

**BY**
**Dr N Manoharan**
**Assistant Proffessor**
**Department Of Marine Science**
**Bharathidasan University**
**Tiruchirapalli -24**

# Seaweed Polysaccharides

Marine polysaccharides from seaweeds are an integral part of a globally thriving marine-bio industry . Seaweeds are themost abundant source of polysaccharides as alginate,agar,fucoidan, agarose, as well as carrageenan.

# Alginate

Alginate is an anionic polysaccharides and commonly available in cell wall of seaweed. It forms a viscous gum with water and having capacity to absorb water around 200–300 times of its own weight .

## Biomedical applications of alginate

- Alginate forms mild gelation by addition of divalent cation Ca2þ and have been extensively studied and applied as a biomaterial in wound healing, tissue engineering,

- The thickening, gel-forming and stabilizing property of alginate adds it amongst the most widely used biopolymer with broader range of applications including tissue engineering, drug delivery, biosensor, and wound dressing.

## Tissue engineering

Composite materials of alginate with ceramics play a major role in increasing the mechanical strength of extracellular matrix. Injectable calcium phosphate-alginate hydrogel-umblical cord mesenchymal stem cell (UCMSC) paste

## Drug delivery

Alginate is used for immediate release of drug and sustained release of drug for rapid absorption and gives a reproducible and kinetically predictable release of drug substances respectively.

## Wound healing

In vivo studies using adult male BALB/c/Bkl-nu/nu mice in which a fibrin glue mixture was subcutaneously injected in to the wound of the animal showed scaffolds resized in to 8 mm diameter and washed with 20 mL of Dulbecco's modified eagle medium (DMEM) prior to grafting on the wound bed.

## Biosensor

Alginate in an aqueous-phase reaction can provide pyrrole-
alginate conjugate, dehydrated alginate beads,synthesized biotin-alginate conjugates

## Carrageenans

Carrageenan an anionic sulfated polysaccharides, has straight chain backbones of alternating 3-linked b-D-galactopyranose, 4-linked a-galactopyranose residue.

## Biomedical applications of carrageenans

Carrageenans have been extensively studied marine derived polysaccharides in drug delivery, tissue engineering, and wound heading applications.

## Tissue engineering

Carrageenan-graphene oxide composite facilitate the nucleation of hydroxyapatite (HA) and enhance adhesion,morphology, and proliferation of MC3T3-E1 cells and also similar to carrageenan-chitosan composite was developed for bone tissue engineering.

## Drug delivery

In drug delivery, carrageenan have been applied in the different forms such as nanoparticles, nano and micro stabilizers, gelling agent, beads, microspheres as well as in microcapsules.

# Wound healing

The usage of k-carrageenan in wound healing/dressing is limited. However, preliminary laboratory studies of poly (N-vinly-2-pyrrolidone)-k-carrageenan hydrogels exhibit a good mechanical strength, transparency, biocompatibility, prevention of bacterial infection, control over evaporative water loss from wound surface, and permeability for gases which are prerequisites for use in wound dressing applications

## Biosensor

k-carrageenan gel immobilized with superoxide dismutase enzyme was used as biosensor in determining superoxide radicals gotten by coupling a transducer consisting of an amperometric gaseous diffusion electrodes for oxygen, or another amperometric electrode for hydrogen peroxide and showed good response to the superoxide radical

## **Fucoidan**

Fucoidan, first isolated by Kylin [66, 67] is known to produce
much immmunobiological responses [68] in humans. The larger proportion of fucoidan for example consist of molecular L-fructose, sulphate, and other minor sugars such as xylose, galactose, mannose, and glucuronic acid

## Tissue engineering

Low molecular weight fucoidan reinstates as well as mimics proteogylacans, glycoproteins which are features of non-collagenous matrix of bone whose bioactive properties can be compromised by the drastic purification of biomaterial in fabrication process to control introduced soluble factors bioavailability.

## Drug delivery

The production of chitosan/fucoidan micro-complex hydro-gel has been reported to serve as carrier for the controlled release of heparin binding growth factors e.g., fibroblast growth factor (FGF).

## Wound healing

Murakami et al. revealed that hydrogel sheet fabricated by combination of alginate, chitin/chitosan, and fucoidan is favorable as wound healing agent by repairing impaired wounds through the stimulation of repair of mitocycin treated healing impaired wounds in rats.

# Ulvan

Ulvan composed of structural subunits of uronic acids and neutral sugars i.e., glucuronic acid, iduronic acids, rhamnose, xylose, and glucose residues respectively . Ulvan have repeating disaccharide unit of b-D-glucuronosyl-(1, 4)-a-L-rhamnose 3-sulfate (aldobiouronic acid).

## Tissue engineering

Biofunctionalized ulvan hydrogels with ALP enzyme serves as mineralization inducers in osteoblastic differentiation and the cytocompatibilty of ulvan as well as it relative membrane are promising features for scaffold development.

## Drug delivery

Ulvan memberance is proposed to be a novel deliver of therapeutics and or drugs in wound treatment [101]. Ulvan is also known to contribute to antihyperlipidemic actions due to its highly negatively consituted subunits.

# Biological application of Ulvan

Ulvan have exhibited strong antioxidant, antitumor, immunostimulatory, anti-inflammatory, pulmonary fibrosis anticoagulant/antithrombotic, lipid lowering, antiviral, antibacterial, antiprotozoan, hyperplasia prevention, gastro intestinal, regenerative, and nano medicine applications.

# THANK YOU.....